

**Issues Under 35 U.S.C. § 112, Second Paragraph**

Claims 4, 5, 12 and 13 are rejected by the Examiner under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner asserts that the phrase "co-sinter type" is indefinite because the of the word "type". Applicants have amended claim 4 to recite "A solid electrolyte type fuel battery in which an interconnector produced by sintering is used for connecting cells..." Support is found on page 6, lines 15 and 16 of the instant Specification.

**Issues Under 35 U.S.C. § 103**

Claims 4-17 are rejected by the Examiner under 35 U.S.C. § 103 as being unpatentable over Soma et al. (U.S. Patent No. 5,411,767). The Examiner asserts that the invention would have been obvious to one of ordinary skill in the art because the direction of current collection is a design choice that may be manipulated according to the needs of the artisan. The Examiner asserts that the limitations of "co-sinter type" and "integrally burned" in the claims do not patentably distinguish the instant invention from Soma et al, and notes that the courts have held that using a one-piece construction instead of the structure disclosed in the prior art (i.e., "making integral") would merely be a matter of obvious engineering choice. The Examiner further asserts that the claimed subscript ranges are obvious. Applicants

respectfully traverse and request reconsideration and withdrawal of the rejection.

**A. The Limitation "Produced By Sintering" in the Amended Claims Patentably Distinguishes the Present Invention from the Prior Art**

The instant invention is drawn to an interconnector formed by coating materials onto a surface (e.g., the surface of a base tube) and sintering them. The interconnector of the Soma et al. reference, in contrast, is formed by thermally spraying an interconnector material to form a thermally sprayed film, and then heat-treating (1,250°C or higher) the thermally sprayed film. Soma et al. only discloses a fuel cell produced by a thermal spraying process. Soma et al. fails to disclose a fuel cell produced by a sintering process. Thus, the interconnector of the invention is patentably distinct from the interconnector of Soma et al.

In Soma et al., at column 11, lines 3-10, the method of the invention is described. Briefly, a material for interconnector is thermally sprayed and the resulting thermal spray film is heat-treated. The benefits of this method are disclosed to be that the open pores of the thermal spray interconnector film can be converted to closed pores, fine cracks or defects characteristic of a plasma spray film can be eliminated, the relative density can be increased, and the porosity can be decreased. Thus, the method

of Soma et al. solves only the problems characteristic of a thermal spray film and makes no mention to a fuel cell produced by sintering.

The instant invention is further distinguished from Soma et al. in that the adhesion properties of the sintering method are superior to those of the thermal spraying method. Attached herewith, please find referential views (A) and (B), which depict bonding interactions resulting from thermal spraying and sintering, respectively. As shown in the referential view (A), bonding according to thermal spraying occurs by a weak intermolecular force such as static electricity. In contrast, as shown in referential view (B), bonding according to sintering, occurs through chemical bonds in which oxygen is shared, resulting in a stronger bonding force. Due to this difference in bonding force, the sintering process of the instant invention exhibits increased adhesion as compared to the thermal spraying process of Soma et al.

**B. Sintering is Not an Obvious Engineering Choice in the Production of a Fuel Cell**

Not only is the interconnector of the instant invention patentably distinct from the fuel cell of Soma et al., but also, producing a fuel cell by sintering rather than thermal spraying is not an obvious engineering choice. A fuel cell produced by

sintering according to the present invention possesses superior characteristics as compared to a fuel cell produced by thermal spraying according to Soma et al.

	Fuel cell by thermal spraying (citation)	Fuel cell by sintering (present invention)
Required time for production	150 min/fuel cell	15 min/fuel cell
Yield on materials	3 - 10%	90% or more
Equipment cost	Basic amount	1/10
Construction cost	Basic amount	1/5
Materials cost	Basic amount	1/2
Cell production cost	130 million yen/kW	5 million yen/kW

Table 1

$$Ca_{0.7}La_{0.3}TiO_3$$

The attributes of fuel cells produced by sintering (instant invention) as compared to fuel cells produced by thermal spraying (Soma et al.) are shown in Table 1 above. The production time, equipment costs, construction costs, material costs and production cost are much lower for fuel cells produced by sintering. Additionally, the yield on materials is much higher for a fuel cell produced by sintering. Thus, production of a fuel cell by sintering simplifies the procedure allowing work efficiency to increase.

The conventional thermal spraying method for making fuel cells requires very laborious steps. For example, the method requires a) thermally spraying a material for a fuel electrode onto a substrate 11 to form a fuel electrode 12, (b) thermally

spraying a material for an electrolyte to form an electrolyte 13, (c) thermally spraying a material for an interconnector to form an interconnector 14, and (d) thermally spraying a material for an air electrode to obtain an air electrode 15. In contrast, the sintering process employed in the present invention involves only sintering.

An additional reason why the instant invention is not obvious over Soma et al. is that the material employed for the interconnector in a fuel cell produced by thermal spraying cannot necessarily be used for the interconnector in a fuel cell produced by sintering. The Applicants are the first to disclose the use of a material having a matrix of the general formula  $MTiO_3$  where M is Mg, Ca, Sr, or Ba in an interconnector produced by sintering.

Soma et al. suggests the use of a material for an interconnector produced by thermal spraying not for an interconnector produced by sintering. On page 6, lines 9-14 of the instant invention, it is stated that the material of the instant invention can be burned at temperatures ranging from 1,300 °C to 1,400 °C. This temperature range is much lower than the conventionally high temperature of 1,600 °C. Soma et al. fails to address this issue. As such, production of a fuel cell by sintering is not obvious in view of Soma et al.

C. The "Vertical Direction" of the Series-Connected Fuel Cells is Not an Arbitrary Direction.

Vertical collection of current would not have been an obvious design choice for one of ordinary skill in the art of producing fuel cells. Figures 44(a) and 44(b) of the instant invention depict vertical and horizontal current collection. As shown in Figure 44 (a) and described on page 34, lines 8-10, vertical current collection is advantageous because high resistance can be evaded by thinness of the interconnector. In vertical collection of current, the air electrode 15 is located just above the fuel electrode 12 via the interconnector 14. By thinning the layer of the interconnector, overvoltage due to resistance of the interconnector is decreased. A perspective view of the model of Figure 44 (a) is attached herewith.

In contrast, Figure 44(b) shows that current collection in the horizontal direction is disadvantageous because it is not applicable for high resistance material. In horizontal current collection, current needs to be passed through the thin film in the same direction as the axial direction. Thus, a decrease in overvoltage cannot be achieved.

As discussed above, horizontal current collection and vertical current collection are different processes which possess different properties. Thus, the vertical direction of the fuel cells of the instant invention is not an arbitrary design choice.

**CONCLUSION**

As the above-presented amendments and remarks address and overcome all of the rejections presented by the Examiner, withdrawal of the rejections and allowance of the claims are respectfully requested.

If the Examiner has any questions concerning this application, he is requested to contact the undersigned, at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 

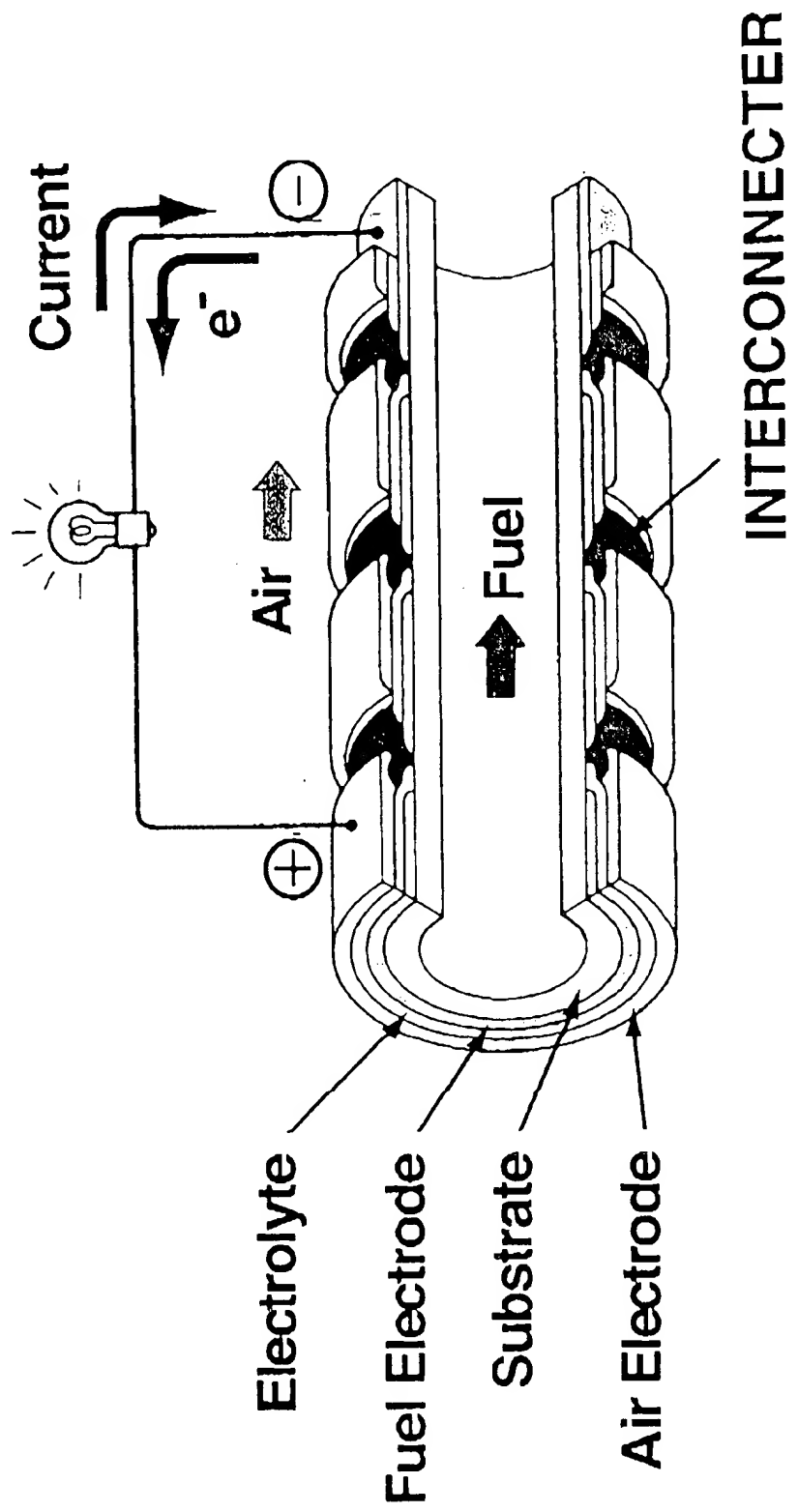
Marc S. Weiner  
Reg. No. 32,181

MSW/ELH/gml  
Attachments

P. O. Box 747  
Falls Church, VA 22040-0747  
(703) 205-8000

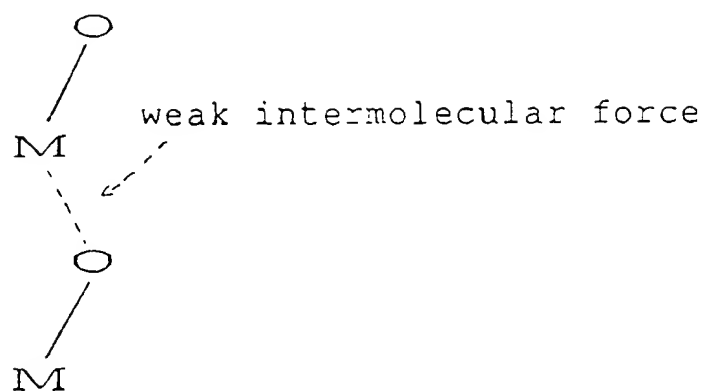
# BACKGROUND (1)

## Scheme of Tubular Cell





R e f. (A)



R e f. (B)

